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ABSTRACT

This book of pretests and review exercises is designed to accompany the Engine Tune-Up Service Student Guide for Unit 2, Charging System, available separately as CE 031 208. Focus of the exercises and pretests is testing the charging system. Pretests and performance checklists are provided for each of the three performance objectives contained in the unit. There are six review exercises that are short check-ups to let the student know how well she/he has learned the material for one or more work activities covered in the Student Guide. Answers to all of the exercises are found at the back of the book. (YLB)

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ENGINE TUNE-UP SERVICE

Unit 2: Charging System

Review Exercise Book

Automotive Mechanics Curriculum

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HOW TO USE THIS BOOK

In this Review Exercise Book, you'll find pretests and review exercises. These tests and exercises cover the material in the Student Guide. The Student Guide will tell you when to do a review exercise, so don't start doing any of these exercises just yet.

PRETESTS

You will take the pretest for Unit 2 before you start working through the Student Guide. A pretest is a test designed to help you and your instructor find out what you already know. The questions on the pretest may also be used to help you review what you've learned after studying the material and doing the activities.

REVIEW EXERCISES

A review exercise is a short check-up that lets you know how well you've learned the material for one or more work activities covered in the Student Guide. It is a way of testing yourself. The back of this book contains the answers to all the exercises.

You might be tempted to turn to the answers before you complete the questions, but if you do, you'll be the loser—for two reasons. In the first place, automotive mechanics is a skilled and dangerous trade. You need to know what you're doing and how to do it safely without having to check the book on every step. If you don't learn the material well, you can hurt yourself or damage the vehicle. In the second place, you'll eventually be graded by your instructor on how well you can do a performance objective. So if you look at the answers first, you'll just be wasting your time.

After you answer all the questions in a review exercise, check your answers with the ones in the back of the book. Review the material in the Student Guide for any question you had trouble with. Talk with your instructor if you're still unsure about any of the material covered in the Student Guide.

FINAL TESTS

These are the only two tests on which you'll be graded. One of the tests will be a written test, and the other will be a performance test. If you've studied the material in the Student Guide, and if you've done the exercises and work activities as required, you'll have no trouble doing well on these final tests. You may even find them easy and fun to complete.

UNIT 2 PRETEST

NAME_____

1. Place a check mark beside each major component of the charging system.

_____ a. contact points
_____ b. regulator
_____ c. high-tension cables
_____ d. battery
_____ e. cranking motor
_____ f. electrical equipment
_____ g. fan belt
_____ h. alternator
_____ i. ballast resistor
_____ j. chassis
_____ k. alternator belt
_____ l. wires

2. When a problem exists in the electrical system, you should first check the:

_____ a. battery
_____ b. fuses
_____ c. wiring
_____ d. regulator
_____ e. alternator

3. Most modern vehicles are equipped with:

_____ a. an alternator
_____ b. a generator

For Questions 4-10, place a check mark by the correct answer. Do not fill in the blank.

4. The alternator produces _____ current.

   _____ a. 110-volt
   _____ b. DC
   _____ c. AC

5. Most of a car's electrical parts are designed to operate on _____ current.

   _____ a. 110-volt
   _____ b. DC
   _____ c. AC

6. The alternator's output is rectified by _____ to match the needs of the vehicle's electrical system.

   _____ a. capacitors
   _____ b. diodes
   _____ c. resistors
   _____ d. transistors

7. The regulator's function is to control the _____ in the charging system.

   _____ a. current produced
   _____ b. capacitance
   _____ c. resistance
   _____ d. current used

8. If the charge indicator light does not go out or the ammeter does not register when the vehicle is started, then you know that the _____

   _____ a. battery is defective
   _____ b. charging system is not working properly
   _____ c. regulator is defective
   _____ d. alternator is producing current

9. The _____ regulator is located somewhere in the engine compartment.

   _____ a. external
   _____ b. internal

10. The _____ regulator is located inside the alternator.

    _____ a. external
    _____ b. internal

11. Place a check mark beside the conditions of an alternator belt that could cause the alternator to operate poorly.

    _____ a. frayed belt
    _____ b. tight belt
    _____ c. cracked belt
    _____ d. worn belt
    _____ e. stiff belt
    _____ f. loose belt

12. What tool should you use to check the alternator belt tension?

_____ a. belt tightener
_____ b. torque wrench
_____ c. strand tension gauge
_____ d. micrometer
_____ e. dynamic tension gauge

13. For a charging system output test, the recommended limit for the alternator output voltage is:

_____ a. 14 volts
_____ b. 16 volts
_____ c. 18 volts
_____ d. 24 volts

14. The steps listed below for removing and replacing an alternator belt are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Tighten the alternator adjusting bolt.
_____ 2.	b. Loosen the alternator adjusting and mounting bolts.
_____ 3.	c. Tighten the alternator mounting bolt.
_____ 4.	d. Install the alternator belt and move the alternator away from the engine with a pry bar.
_____ 5.	
_____ 6.	e. Move the alternator toward the engine.
_____ 7.	f. Remove the belt and check for wear and damage.
	g. Adjust the belt tension to specifications.

15. The steps listed below for making a charging system output test are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Start the vehicle and operate it at about 2000 RPM.
_____ 2.	b. Compare the output to the manufacturer's specifications.
_____ 3.	c. Hook up the volt-amp tester.
_____ 4.	d. Decide whether the system output is okay.
_____ 5.	e. Use the carbon pile rheostat to hold the voltage at a specified value.

16. A major cause of excessive (too much) resistance in the charging system's insulated circuit is:

_____ a. loose or corroded wiring connections
_____ b. a blown fuse in the fuse block
_____ c. an undercharged battery
_____ d. a defective ballast resistor

17. Place a check mark beside each quick check of the charging system you can make ***before*** you hook up test equipment.

_____ a. Make sure that the test equipment is calibrated.
_____ b. Check the terminals and wiring connections.
_____ c. Listen for unusual noises coming from the alternator.
_____ d. Inspect the alternator and regulator for physical damage.
_____ e. Check for voltage drop.
_____ f. Check the alternator output voltage.
_____ g. Inspect the alternator belt.
_____ h. Check the vehicle manufacturer's specifications.
_____ i. Check the battery.
_____ j. Inspect the wiring for wear.

18. What equipment do you need to make a charging system output test?

_____ a. voltmeter only
_____ b. ammeter only
_____ c. volt-amp alternator tester
_____ d. voltmeter and ammeter
_____ e. ammeter and ohmmeter

19. A defective regulator is typically:

_____ a. replaced
_____ b. serviced

20. Place a check mark beside all of the components that might be at fault if a voltage regulator circuit test shows voltages that are outside of tolerance.

_____ a. ammeter
_____ b. faulty grounding of regulator
_____ c. bad wiring connections
_____ d. alternator belt
_____ e. alternator
_____ f. voltage regulator

21. Place a check mark beside each place that should be inspected when there is excessive insulated circuit resistance.

_____ a. alternator housing
_____ b. wiring from the ammeter to the solenoid
_____ c. ammeter terminals
_____ d. alternator output terminal
_____ e. battery ground cable clamp connection
_____ f. solenoid battery terminal connection

Questions 22-26 deal with the proper testing sequence for the charging system. Answer each question by choosing the best answer from the list below and writing its letter in the blank.

a. charging circuit
b. insulated circuit
c. ground circuit
d. battery
e. alternator
f. voltage regulator

22. If the charging system output is more than 10 percent above the rated output, the _____ should be tested next.

23. If the alternator output test results are okay, the _____ should be replaced.

24. Make insulated circuit resistance test when the _____ test results are above normal.

25. Make ground circuit resistance test if the _____ test results are okay.

26. If the ground circuit test results are okay, the _____ is probably defective.

27. The ground circuit resistance test checks the resistance between the battery ground post and the:

_____ a. chassis
_____ b. alternator housing
_____ c. battery ground cable clamp
_____ d. alternator output terminal
_____ e. voltage regulator field terminal

28. The steps listed below for removing and replacing an alternator are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Loosen and remove the alternator adjusting bolt.
_____ 2.	b. Install the alternator and adjust the belt tension to specifications.
_____ 3.	c. Mark and disconnect the wires from the alternator.
_____ 4.	d. Remove the alternator mounting bolt and lift the alternator from the vehicle.
_____ 5.	e. Start the engine and make a system output test.
_____ 6.	f. Disconnect the battery ground cable clamp.
_____ 7.	g. Loosen the alternator mounting bolt and remove the alternator belt.

29. When adjusting the alternator belt tension, where on the alternator should you place the pry bar?

_____ a. at the alternator pulley
_____ b. at the alternator mounting bolt
_____ c. where the body halves join
_____ d. where the wires are connected

30. You can tell whether an alternator has faulty bearings by:

_____ a. inspecting the alternator pulley
_____ b. using a mechanic's stethoscope to listen for bearing noises
_____ c. racing the engine from the driver's seat and listening for squealing noises
_____ d. examining the alternator belt for excessive wear

31. The steps listed below for removing and replacing an alternator pulley are out of order. Write the letter of each step in the blank beside the proper number to show the correct sequence.

Order	Steps
_____ 1.	a. Remove the pulley from the alternator.
_____ 2.	b. Clamp the alternator in a vise.
_____ 3.	c. Remove the pulley retaining nut.
_____ 4.	d. Tighten the pulley retaining nut.
_____ 5.	e. Install the pulley on the alternator shaft.

32. The fusible link in the charging system serves to:

_____ a. insulate the circuit from the ignition switch
_____ b. protect the circuit components from being overloaded
_____ c. regulate the amount of alternator output
_____ d. regulate the amount of battery output
_____ e. insert resistance in parallel to the indicator light or ammeter

When you finish this pretest, carefully tear it out of the book and give it to your instructor. After s(he) has checked your answers, your instructor will direct you either to practice the work activities or to study the material covered by this test.

EXERCISE 1

1. The second major step in the performance of the tune-up service involves the tests and services around the _____ system.

2. List four main components of the charging system.

   a. _____

   b. _____

   c. _____

   d. _____

3. What component in the charging system should always be checked first?

   _____

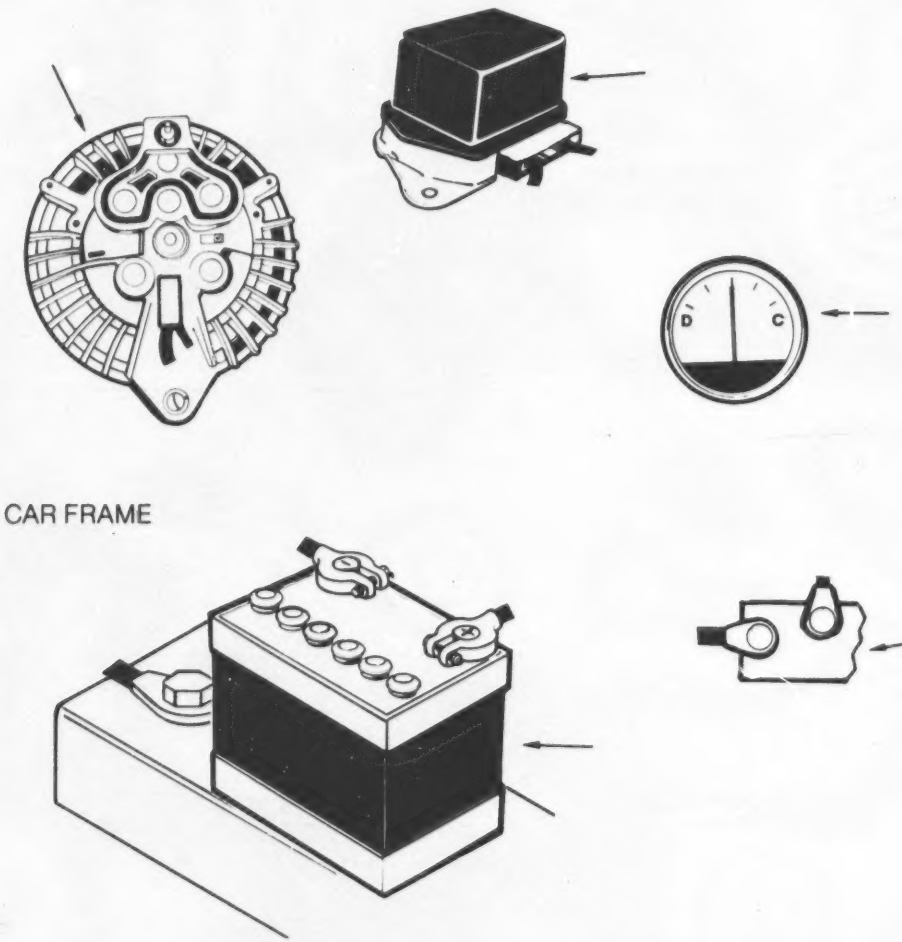
4. Which major component of the charging system causes the alternator rotor to turn?

   _____

5. In the blanks below, write *T* (for true) or *F* (for false).

   _____ a. Alternating current is electric current that flows through a circuit first in one direction, then the other.
   _____ b. Direct current is current that flows in only one direction.
   _____ c. The field circuit is a section of the alternator that weakens the flow of current.
   _____ d. Field current is current that flows through a field winding in the alternator.
   _____ e. Field windings are insulated wires wrapped around an iron or steel core to help weaken the flow of current in the cranking motor or generator.

6. On the illustration below:
   a. draw the charging circuit wiring
   b. draw all wiring connections and grounds
   c. label each part identified by an arrow



Charging System Components

Now turn to the back of this book and check your answers for Exercise 1.

EXERCISE 2

1. Why is it unsafe to work under the hood without fender covers? _____

   _____

   _____

2. Why is it unsafe to adjust or replace an alternator belt without first removing the ignition key from the ignition switch? _____

   _____

3. Why shouldn't you pry against one end of the alternator while adjusting the alternator belt? _____

   _____

4. What are the two main problems that may be found with the alternator belt?

   a. _____

   b. _____

5. Imagine that you are working on an automobile with a matched pair of alternator belts. One of the belts is worn. You should:

   _____ a. replace the worn belt only
   _____ b. adjust the tension on the other belt
   _____ c. adjust the tension on both belts
   _____ d. replace both belts
   _____ e. replace the worn belt and tighten up the other belt

6. List the procedures for replacing the alternator belt.

   a. Loosen the _____ bolt.

   b. Loosen the _____ bolt.

   c. Move the _____ toward the engine.

   d. Slip the alternator belt from the _____, _____, and _____ _____ and lift it off.

   e. Place the new belt over the _____, _____, and _____ pulleys.

   f. Adjust the belt _____ to manufacturer's _____ .

   g. To adjust, pry the _____ away from the engine until the belt tension is correct.

   h. Tighten the alternator belt _____ bolt and the _____ bolt securely.

7. When testing notched belts, where should you place the tension gauge belt hook?

   _____

8. When testing the alternator belt tension, the belt tension is placed:

   _____ a. on the belt near the alternator

   _____ b. on the belt near the water pump

   _____ c. on the belt halfway between the alternator and the water pump

   _____ d. on the belt between the crankshaft pulley and the alternator

Now turn to the back of this book and check your answers for Exercise 2.

PERFORMANCE CHECKLIST—P. O. 5

The instructor will provide a vehicle on which the student can remove and replace the alternator belt. All necessary tools, equipment, and manuals must be made available.

Student Performance	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Loosens the alternator adjusting (cap) bolt.			
2. Loosens the alternator mounting bolt.			
3. Moves the alternator toward the engine.			
4. Removes the belt and inspects it for damage or wear.			
5. Checks the pulleys for burrs and rough spots.			
6. Installs a new (or old, if okay) belt over the pulleys.			
7. Using a suitable pry, pries the alternator outward from the engine.			
8. Checks the belt tension against specifications, using a belt tension gauge.			
9. Tightens the alternator adjusting bolt.			
10. Tightens the alternator mounting bolt.			
11. Uses proper tools and equipment.			
12. Follows all safety precautions.			
13. Time.			

Keep this checklist for your records.

EXERCISE 3

1. The main function of an alternator is to produce _____ for electric components in the vehicle.

2. Alternating current in an alternator is changed (rectified) by a device called a _____ _____ .

3. The function (job) of the alternator regulator is to _____ the _____ output of the alternator.

4. What are the two basic types of alternator regulators?

   a. _____

   b. _____

5. The external regulator system has a charge indicator light that comes on when the ignition is turned to start the engine. When the engine is running and the system is charging, the light will:

   _____ a. stay on
   _____ b. turn off

6. a. The purpose of the field relay is to supply current from the _____ to the _____ when the engine starts.

   b. The field relay also disconnects the current from the _____ to the _____ when the ignition switch is turned off.

7. The purpose of the ammeter gauge is to tell the driver when the _____ is being charged and how much it is being charged.

8. The purpose of the voltage limiter is to prevent _____ of the alternator and the regulator circuits at high and medium driving speeds.

9. The purpose of the fusible link is to serve as an _____ in the charging system.

10. Why is it unsafe to perform electrical tests while standing in water or on a wet surface?

    _____

    _____

11. Why is it unsafe to connect a volt-amp tester to the charging circuit while the engine is running?

_____

_____

Now turn to the back of this book and check your answers for Exercise 3.

EXERCISE 4

1. List at least five visual checks you should make before conducting any charging system tests.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

2. Before checking for noises coming from around the alternator, there are two things you should check:

   a. _____

   b. _____

3. If the alternator is still noisy, you'll need to use a _____ to pinpoint the problem.

4. When performing a charging system output test, what is the normal voltage setting?

   _____

5. When performing an output test, you should not let the voltage go higher than:

   _____ a. 10 volts
   _____ b. 12 volts
   _____ c. 14 volts
   _____ d. 16 volts
   _____ e. 18 volts

6. To do a charging system output test, what two test instruments do you need?

   a. _____

   b. _____

7. Where do you hook up the tester leads to make a charging system output test?

   a Connect the red positive tester lead to the _____ terminal on the battery. .

   b. Connect the black negative tester lead to the _____ terminal on the battery.

   c. Attach the ammeter clamp-around probe to the _____ .

8. If the charging system output test has a rating lower than the rated output, you should:

   _____ a. replace the regulator
   _____ b. perform a circuit resistance test
   _____ c. perform an alternator output test
   _____ d. replace the alternator belt

9. Where do you hook up the tester leads to make an alternator output test?

   a. Attach the tester field control lead to the _____ terminal on the alternator.

   b. Attach the volt-amp tester leads to the battery; the positive lead attaches to the _____ terminal, the negative lead to the _____ terminal.

   c. Attach the ammeter clamp-around probe to the _____ .

10. When performing an alternator output test for the Delcotron IOSI integral charging system, you ground the field in the alternator by inserting the tip of a _____ into the _____ _____ _____ and ground the _____ _____ _____ .

11. If the alternator output test is within 10 percent of the manufacturer's specifications, yet the charging system output test results are ***lower*** than the rated output, you should:

    _____ a. replace the alternator
    _____ b. replace the battery
    _____ c. replace the regulator
    _____ d. replace the alternator belt

12. The voltage regulator circuit test tells you whether the _____ _____ is faulty.

13. What are the two types of charging circuit resistance tests?

    a. _____

    b. _____

14. The system circuit resistance test is performed to identify voltage loss in what two areas?

    a. _____

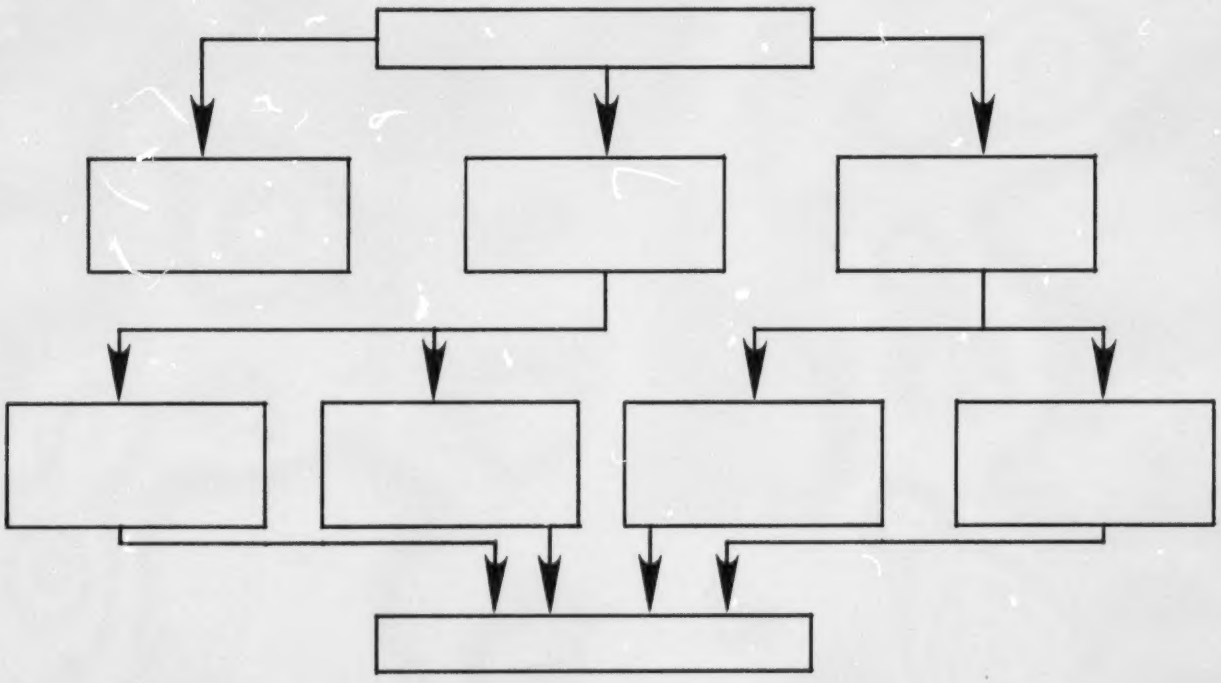
    b. _____

Now turn to the back of this book and check your answers for Exercise 4.

EXERCISE 5

The numbered items below are steps in the charging system test sequence. Place the ***number*** of each step in the correct block of the diagram.

Charging System Test Sequence



1. The voltage regulator is bad; replace, or adjust if possible.
2. Retest the charging system.
3. Ten percent below rated output; perform the alternator output test.
4. The alternator is okay; replace the regulator.
5. Conduct the charging system output test.
6. Meets rated output; the charging system is okay.
7. Ten percent above rated output; perform the voltage regulator test.
8. The voltage regulator is okay; perform the circuit resistance test.
9. The alternator output is 10 percent below the rated output; repair or replace.

Now turn to the back of this book and check your answers for Exercise 5.

PERFORMANCE CHECKLIST—P. O. 6

The instructor will provide a vehicle on which the student can test the charging system. All necessary tools, equipment, and manuals must be made available.

Student Performance	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Checks the battery first.			
2. Performs the charging system output test and records the results.			
3. Performs the alternator output test and records the results.			
4. Performs the voltage regulator test and records the results.			
5. Performs the circuit resistance test and records the results.			
6. Performs the insulated circuit resistance test and records the results.			
7. Performs the ground circuit resistance test and records the results.			
8. Compares the test results to the manufacturer's specifications and reports any defective components.			
9. Uses proper tools and equipment.			
10. Follows all safety precautions.			
11. Time.			

Keep this checklist for your records.

22

EXERCISE 6

1. Why is it not safe to remove and install an alternator without first removing the ignition key from the ignition switch? _____

   _____

2. Why shouldn't you pry against one end of the alternator while adjusting the alternator belt? _____

   _____

3. Why should you never adjust the alternator belt without following the manufacturer's specifications? _____

   _____

4. The steps for removing an alternator are listed below. Fill in the blanks.

   Step 1 Disconnect the battery _____ cable.

   Step 2 Disconnect the _____ from the alternator.

   Step 3 Loosen the alternator belt _____ bolt and the alternator _____ bolt.

   Step 4 Remove the alternator _____ from the pulley.

   Step 5 Remove the alternator belt _____ bolt and the alternator _____ bolt and remove the alternator from the engine.

5. The steps for changing an alternator pulley are listed below. Fill in the blanks.

   Step 1 Clamp the alternator in a vise by its _____ .

   Step 2 Remove the pulley _____ .

   Step 3 Remove the alternator _____ .

   Step 4 Install the pulley on the _____ of the new alternator.

   Step 5 Tighten the pulley retaining nut to manufacturer's _____ .

Now turn to the back of this book and check your answers for Exercise 6.

PERFORMANCE CHECKLIST—P. O. 7

The instructor will provide a vehicle on which the student can remove and replace the alternator. All necessary tools, equipment, and manuals must be made available.

Student Performance	Instructor Ratings		
	Acceptable	Not Acceptable	Omit
1. Disconnects the ground cable clamp from the battery.			
2. Removes and marks the wires from the alternator.			
3. Removes the adjusting bolt, loosens the mounting bolt(s), and removes the belt.			
4. Removes the mounting bolt(s) and the alternator.			
5. Removes the pulley from the old alternator and installs it on a new alternator if necessary.			
6. Installs a new alternator and replaces the mounting bolt(s), belt, and adjusting bolt.			
7. Adjusts the alternator to provide proper belt tension and tightens the bolts.			
8. Checks the belt tension with a suitable gauge.			
9. Reconnects the wires to the alternator; reconnects the battery cable clamp.			
10. Makes the appropriate output check.			
11. Uses proper tools and equipment.			
12. Follows all safety precautions.			
13. Time.			

ANSWERS TO THE EXERCISES

ANSWERS TO EXERCISE 1

1. charging

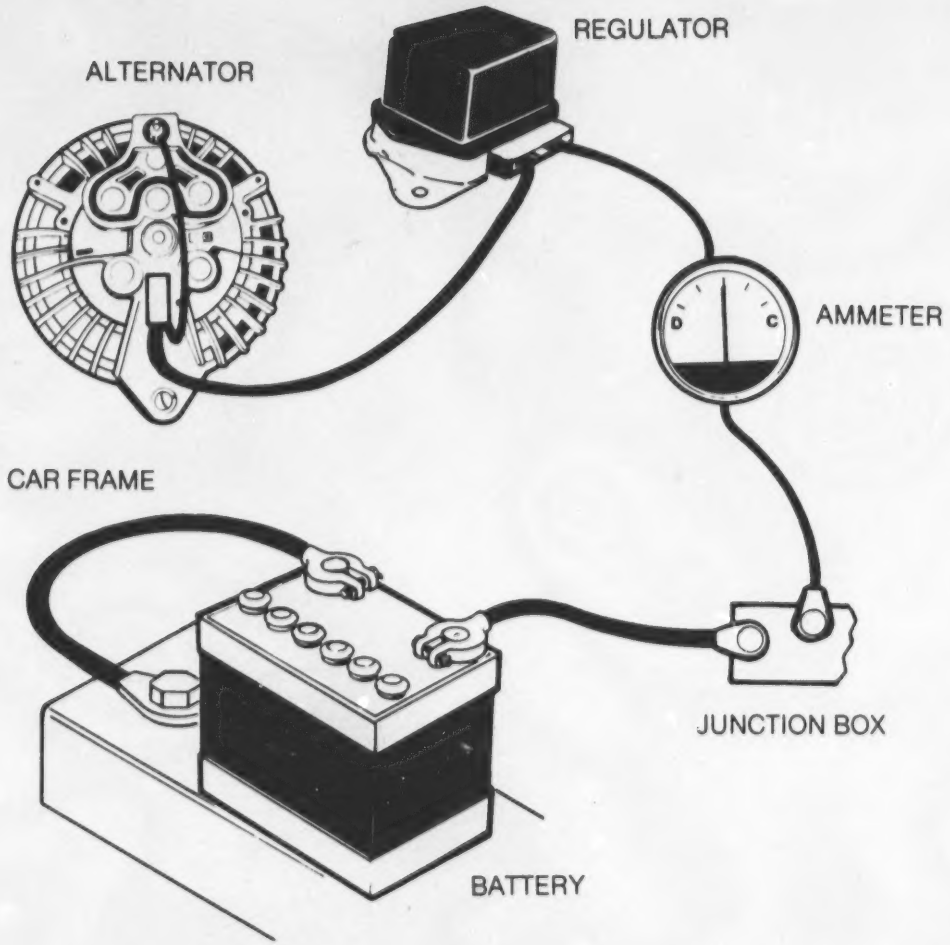
2. (any four)
   battery
   alternator
   alternator/generator belt (fan belt)
   connecting wires
   regulator

3. battery

4. alternator belt

5. a. T
   b. T
   c. F
   d. T
   e. F

6.



Now turn to page 7 in your Student Guide.

ANSWERS TO EXERCISE 2

1. You will scratch and mar the finish on the fenders.
2. Someone may accidently crank the engine while you are working around the alternator.
3. You might damage the alternator.
4. improper tension, belt wear
5. d

6. a. alternator belt adjusting
   b. alternator mounting (pivot)
   c. alternator
   d. alternator, crankshaft, fan pulleys
   e. alternator, crankshaft, fan
   f. tension, specifications
   g. alternator
   h. adjusting, pivot

7. in the spaces between the notches

8. c

Now turn to page 23 in your Student Guide.

ANSWERS TO EXERCISE 3

1. electrical current

2. diode

3. regulate, current

4. external regulator, internal regulator (integrated regulator)

5. b

6. a. battery, alternator
   b. alternator (rotor), battery

7. battery

8. overcharging

9. overload fuse

10. You may receive a painful electrical shock.

11. You could damage the meters of your test equipment.

Now turn to page 34 in your Student Guide.

ANSWERS TO EXERCISE 4

1. (any five)
   a. Always check the battey first.
   b. Check the alternator belt for proper tension, frays, or cracks.
   c. Check all wiring connections to see whether they are tight and properly connected.
   d. Examine wires for signs of wear, burning, or fraying.
   e. Visually check the alternator for signs of physical damage.
   f. Always make sure your test equipment is calibrated before beginning test procedures.

2. Check the alternator belt and belt tension. Also check the alternator mounting for tightness.

3. stethoscope

4. 14 volts

5. d

6. volt-amp tester, tachometer

7. a. positive
   b. negative
   c. battery ground cable

8. c

9. a. field
   b. positive, negative
   c. battery ground cable

10. screwdriver, end frame hole, end frame tab

11. c

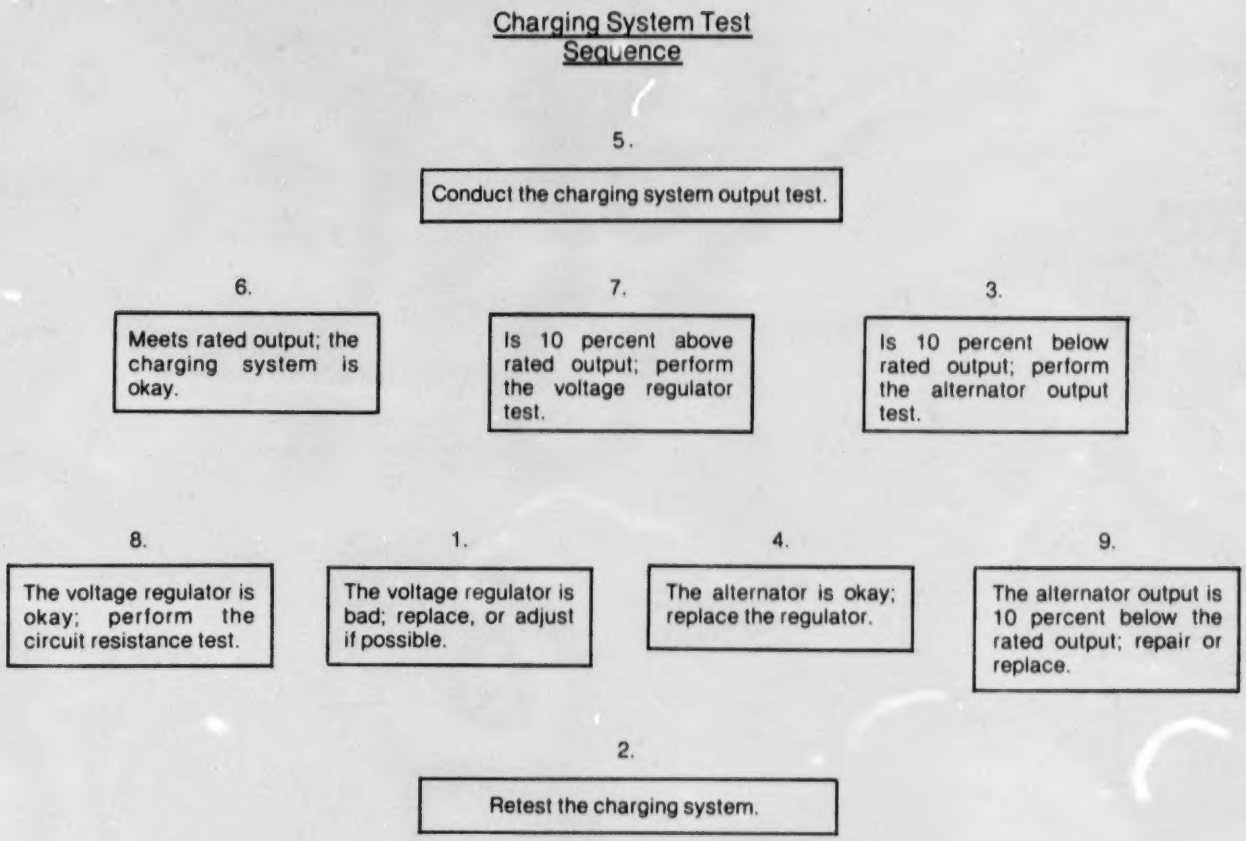
12. voltage regulator

13. insulated circuit resistance test, ground circuit resistance test

14. between the alternator output terminal and the insulated battery post (insulated circuit), and between the alternator housing and the ground battery post (ground circuit)

Now turn to page 51 in your Student Guide.

ANSWERS TO EXERCISE 5


Charging System Test Sequence
5.
Conduct the charging system output test.
6.
Meets rated output; the charging system is okay.
7.
Is 10 percent above rated output; perform the voltage regulator test.
3.
Is 10 percent below rated output; perform the alternator output test.
8.
The voltage regulator is okay; perform the circuit resistance test.
1.
The voltage regulator is bad; replace, or adjust if possible.
4.
The alternator is okay; replace the regulator.
9.
The alternator output is 10 percent below the rated output; repair or replace.
2.
Retest the charging system.

If you placed ***any*** of the steps out of sequence, study the test sequence again to make sure you know the proper sequence.

Now turn to page 53 in your Student Guide.

ANSWERS TO EXERCISE 6

1. It will prevent someone from cranking the engine while you are working around the alternator.

2. You may damage the alternator with the pry bar.

3. It assures proper operation of the alternator.

4. Step 1 ground
   Step 2 wires
   Step 3 adjusting, mounting
   Step 4 belt
   Step 5 adjusting, mounting

5. Step 1 mounting flange
   Step 2 retaining nut
   Step 3 pulley
   Step 4 shaft
   Step 5 torque specifications

Now turn to page 60 in your Student Guide.